Aug. 7, 1945. R. M. URQUHART 2,381,475

APPARATUS FOR MAKING CELLULAR MASSES

Original Filed June 21, 1940

Fig. 1

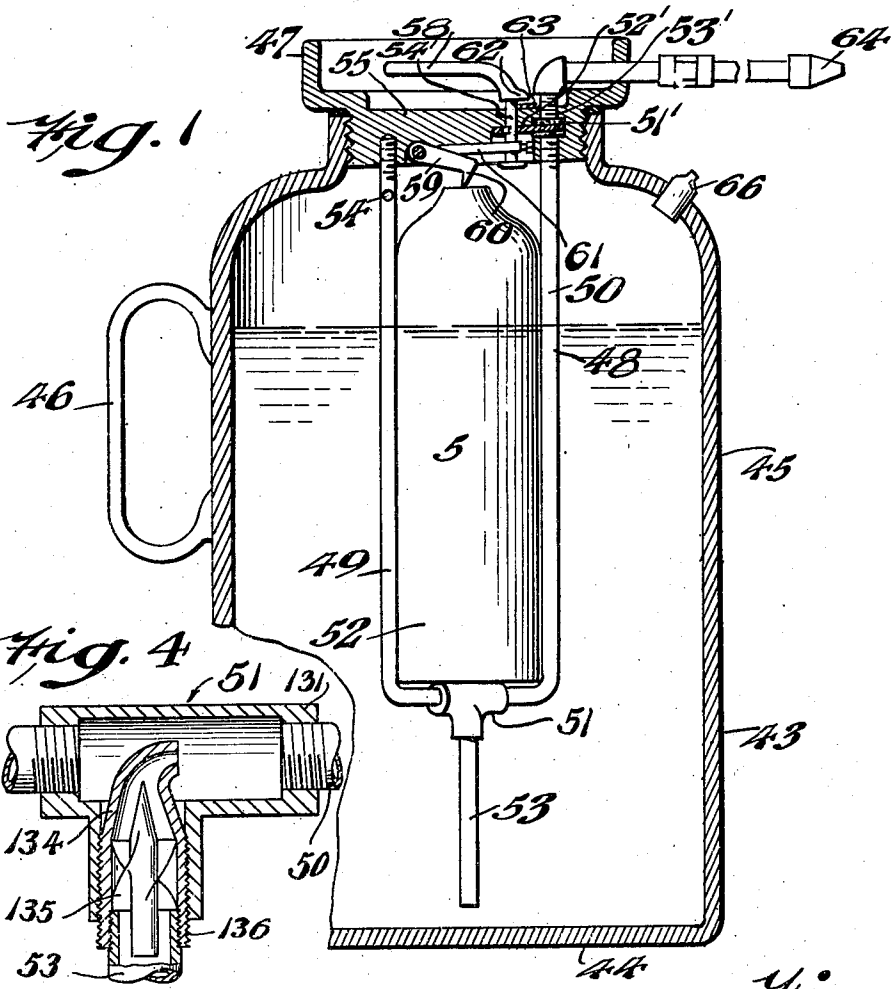


Fig. 4

Fig. 2

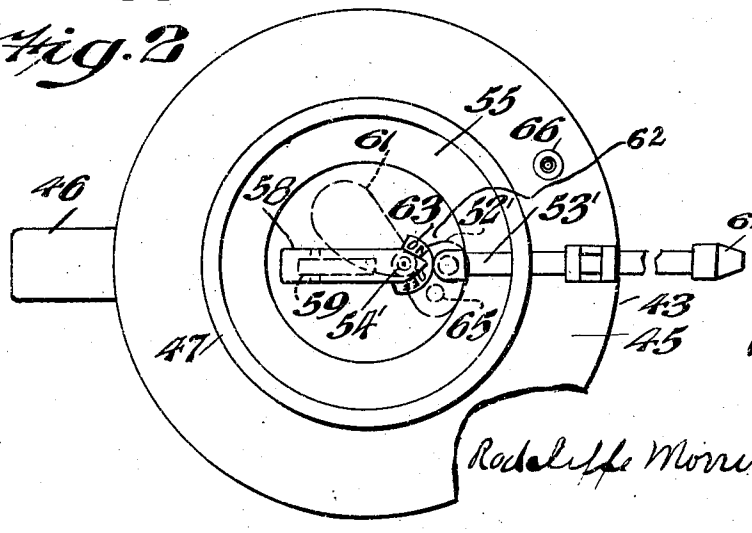
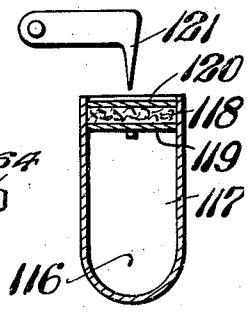


Fig. 3



INVENTOR

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Patented Aug. 7, 1945 2,381,475

UNITED STATES PATENT OFFICE

2,381,475

APPARATUS FOR MAKING CELLULAR MASSES

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Application June 21, 1940, Serial No. 341,938, which is a division of application Serial No. 144,885, May 26, 1937. Divided and this application January 15, 1943, Serial No. 472,520

4 Claims. (Cl. 261—76)

My invention relates to apparatus for making cellular masses, such as foam or the like. The present application is a division of my co-pending application Serial No. 341,938, now Patent No. 2,324,605, for Apparatus for making cellular masses, filed June 21, 1940, which is in turn a division of my abandoned application Serial No. 144,885, filed May 26, 1937, for Apparatus and method for making cellular masses.

Cellular masses, for various purposes, have been made hitherto by means of chemical reactions, physical changes due to variations in heat and pressure, or by various mechanical methods. Most of these means have variously proven unsatisfactory by reason of expense of equipment, chemicals, or fuel, as well as frequent lack of adaptability of the apparatus to the place of application of the product.

Yet, the need is great for inexpensive means for making cellular substances, particularly at the place of application of said substances for the uses for which they are intended; and in many instances, there is an important need for varying the size and integral constituents of the individual cells. Instances of such needs may be found in the fire extinguishing field, the building and construction industries, liquid storage tank fields, the food industries, and fields involving the simulation or reproduction of desired views such as scenic effects.

One object of my invention therefore is to provide means whereby a cellular mass such as foam may be practically, readily and inexpensively produced in the general region of a fire, for fire extinguishing purposes.

Another object of my invention is to provide means for making cellular substances such as insulation, acoustic walls, ceilings, wall fillers, panels and the like, for use in the building or construction industries.

A further object of my invention is to provide means for satisfactorily and inexpensively producing scenic displays.

With the above and other objects in view, my invention consists in means for making a cellular substance, which comprises emitting a liquid capable of supporting foam in the presence of a gas in a manner to increase the surface of said liquid exposed to said gas operatively to entrain the same, and discharging the resultant mass.

My invention also consists in means for producing a cellular mass, which comprises releasing a quantity of gas in the presence of a confined foam promoting liquid operatively to increase the pressure of said liquid and educing a gas into said liquid to form a cellular mass or foam, and discharging the resultant mass.

My invention also consists in means for manufacturing a foam dried in a manner to retain the cellular structure of the foam in a substantially solid form.

My invention also consists in means for varying the physical properties of the cellular mass by regulating the relative quantities of gas, liquid, or cellular mass forming substance.

My invention further consists of the apparatus for making a cellular substance, which comprises a closed container adapted to hold a foam promoting liquid, a supplementary container adapted to release gas under pressure into said liquid container, an eductor adapted to commingle a gas and said liquid in a manner to form a cellular mass, and a discharge conduit adapted to draw off said cellular mass.

My invention further consists of means for producing a substantially solid cellular mass comprising the residual product of a foam comprising liquid, gaseous and cellular-mass forming constituents, with the liquid constituent removed therefrom.

For the purpose of illustrating my invention, I have shown in the accompanying drawing a form of apparatus which has been found in practice to give satisfactory and reliable results, although it is to be understood that the various instrumentalities of which my invention consists can be variously arranged and organized and that my invention is not limited to the precise arrangements and organizations of the instrumentalities as herein shown and described.

Referring to the drawing in which like reference characters indicate like parts;

Figure 1 represents a vertical sectional view of an apparatus of modified construction, for making cellular masses, embodying my invention;

Figure 2 represents a plan view of the apparatus illustrated in Figure 1;

Figure 3 represents a vertical sectional view of a modified gas and chemical release mechanism adapted for use in apparatus, embodying my invention; and

Figure 4 is a sectional view of the adaptor or foam forming means employed in my invention.

Figure 1 illustrates a cellular mass generator comprising a container **43** having a base **44**, cylindrical side wall **45** having a handle **46** secured thereto, and a removable cap **47** securely threaded to the body of the container, and in sealed relation therewith.

The cap **47** has depending therefrom, a cage

48 comprising the tubes 49 and 50, and a rod (not shown). The lower extremities of the tubes and rod are connected to an eductor or proportioner 51 of any suitable and well known form, in a manner to form a base for the compressed gas container 52. For example, proportioner 51 may take the form shown in Figure 4 wherein tube 49 is threaded into one end of proportioner 51. The opposite end 131 of proportioner 51 is threaded to receive tube 50 and between its ends proportioner 51 is provided with a threaded aperture to receive an externally threaded nozzle 134 containing a spiral baffle 135. The outer end of nozzle 134 is in turn threaded at 136 to receive one end of a liquid inlet tube 53. Liquid inlet tube 53 extends from the proportioner 51 to a region near the base 44 of the container 43. The tube 49 has, in the upper portion thereof and in proximity to the top of the inside of the container 43, a port 54.

The upper extremity of the tube 50 leads to a valve 51' comprising a valve disc 52' and a discharge outlet 53'. The valve disc 52' is carried by and keyed to a shank 54' rotatably mounted in the base 55 of cap 47. The shank 54' is rotated by means of a handle 58 of sufficient strength to carry the weight of the generator. An arm 59 is pivotally mounted on base 55 of cap 47 and has downwardly extending therefrom a pin 60 adapted to puncture the top of the compressed gas container 52 when the arm 59 is depressed. A cam 61 is secured to shank 54' in a manner to depress arm 59 when the handle 58 is turned. A suitable indicator 62 is provided on handle 58 to cooperate with suitable direction symbols 63 on the upper face of the cap 47 to indicate the on and off positions of the handle.

In operation, the cage is filled with the gas charged container 52 and the container 43 is filled to a point below the port 54 with any desired cellular mass forming liquid, preferably one having viscous qualities, and the cap 47 is sealed to the container 43. When it is desired to use the generator at any desired location, it is merely necessary for the operator to lift the generator by means of the handle 58, using to assist him, if he so desires, the side handle 46, and to direct the discharge nozzle 64 to the point of application of the cellular mass formed by the generator. When the operator desires to place the generator in active operation, it is merely necessary for him to turn the handle 58 in a counterclockwise direction, thereby puncturing the compressed gas cylinder 52 and simultaneously bringing the port 65 of the valve disc 52' into registry with the tube 50 and the concentric discharge tube 53'. This liberates gas from the compressed gas container 52 into the upper region of the container 43, thereby exerting a great pressure on the liquid in a manner to urge it upwardly through the inlet tube 53 into the proportioner 51. Simultaneously, the liberated gas passes from the upper region of the container 43, through the port 54, into and through the tube 49, into the proportioner or eductor 51. In the eductor or proportioner 51, the liquid is dispersed by subdividing or otherwise increasing the surface area of the stream and the gas and liquid is mixed in a manner similar to that described in my co-pending application Serial No. 472,519 filed January 15, 1943, or Patent 2,106,043 issued January 18, 1938, in which I am a joint inventor, and the mixture is urged upwardly through the tube 50, past the valve 51' and out through the discharge tube 53' and discharge nozzle 64. When it is desired to shut off the flow of cellular mass from the generator, it is merely necessary for the operator to turn the handle 58 in a clockwise direction thereby bringing the port 65 out of registry with the tubes 50 and 53' and closing the valve. A safety valve 66 is provided in the upper portion of the container wall 45 to blow off any excess pressure of gas liberated within the container 43.

The liquid having viscous qualities may be any desired liquid which is capable of entraining a gas. Thus, it may be an aqueous solution of a cementitious material, such as glue, albumen, or of a saponaceous material such as tannin, licorice, soap, spent sulphite liquor, or the like, or any material such as casein, glucose or the like, or combinations thereof capable of altering, forming or supporting a filmy surface in the production of foam.

If desired, a freezing point depressant such as calcium chloride, magnesium chloride, sodium chloride or potassium carbonate may be placed in solution with the liquid to prevent said solution from freezing in the container prior to the operation thereof. Moreover, if desired, a corrosion inhibitor such as potassium chromate or potassium acetate may also be placed in solution with the liquid to protect the elements of the apparatus.

In Figure 3 is illustrated a modified form of a portion of my invention. In this modification I provide a container 116 having two compartments 117 and 118 longitudinally disposed with relation to each other; the inner compartment 117 is adapted to contain compressed gas and the outer compartment 118 is adapted to contain a chemical, which may be in either liquid or powder form. A puncturable diaphragm 119 separates the inner compartment 117 from the outer compartment 118 and a puncturable diaphragm 120 seals the outer compartment from the outside. A puncturing pin 121 is adapted, when the generator is placed in operation, to puncture both the outer diaphragm 120 and the inner diaphragm 119 thereby liberating the gas through the chemical chamber and out of the container 116. In this manner, a desired chemical may be liberated at the same time as the compressed gas, thereby to coact with the cellular mass forming liquid in the generator.

By my novel invention, it is possible to change the character of the emitted cellular mass by varying the pressure or volume of gas introduced thereinto. Thus, for example, but not by way of limitation, a ratio by volume of three parts of gas at average atmospheric pressure and temperature to one of liquid, fed into the eductor or proportioner, will produce a wet cellular mass having substantially wet and free flowing qualities. This cellular mass is of a specific weight much greater than that of a cellular mass having a larger ratio of gas to liquid, used in the generation thereof.

A cellular mass having a ratio of ten parts of gas to one of liquid introduced into the eductor or proportioner will be of a substantially stiff, resilient and very light weight structure, non-free-flowing, but very cohesive. A cellular mass of this ratio tends to cling to almost any solid or liquid surface. It is capable of supporting fairly substantial weight and can be built up into mounds of substantial size for any of various desired uses, such as the building of scenic effects. Such uses include the simulation or reproduction

of glaciers, snow scenes, mountains or rock formations, for photographic purposes. Cellular masses having a ratio of seven or eight parts of gas to one of liquid are of substantially dry characteristics, yet of sufficient ability to flow to enable them to spread when emitted from the discharge nozzle. Such cellular mass is particularly adaptable for use for fire extinguishing purposes. Thus, such foam may be poured on burning surfaces, such as that of volatile liquids, and will spread over such surfaces to suffocate the combustion thereof. Also, such cellular mass will cling to a burning wall, and is capable of forming a blanket thereon to suffocate the combustion thereof.

Furthermore, quick-setting chemicals, such as salts, cement, plaster of Paris, or gypsum derivatives, may be introduced with the cellular mass forming substance to cause the cellular mass discharged from the generator quickly to solidify. Moreover, fire resisting elements such as silicate of soda may also be introduced therewith.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiment is therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the means and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by United States Letters Patent is:

1. Portable apparatus for making a cellular mass comprising a main container for holding a foam forming liquid and having a removable cap; foam forming means suspended in said main container from said cap and comprising a mixing chamber, a liquid inlet conduit discharging into said mixing chamber, a gas inlet conduit for supplying a gas to said mixing chamber and a foam discharge conduit connected to said mixing chamber and extending through said top to deliver foam outside of said main container; a supplementary container, for retaining a quantity of compressed gas, carried on said foam forming means; and means for releasing said gas from said supplementary container into said main container to cause said liquid and said gas to flow through said mixing chamber to form foam and discharge it under influence of the pressure of said released gas.

2. Apparatus for making a cellular mass comprising a main container for holding a foam forming liquid and having a cap; a supplementary container filled with a compressed gas mounted in said main container and having a frangible portion disposed adjacent said cap; foam forming means mounted in said main container and having a foam discharge conduit passing to the outside of said main container; a pivoted pin mounted on the inside of said cap for puncturing said supplementary container to release said gas into said main container; a rotatable shaft provided with a pin actuating cam and a disc valve for normally closing said discharge conduit; and means for rotating said shaft to simultaneously move said pin to puncture said supplementary container and move said valve to open said discharge conduit to place said apparatus in operation.

3. A supplementary container for insertion in the main container of a foam generator comprising a container having an open top, a gas tight seal dividing said container into a gas chamber and a chemical chamber, a gas under pressure in said gas chamber, a chemical in said chemical chamber and a second gas tight seal at the top of said container for sealing said chemical chamber.

4. Apparatus for making a cellular mass comprising a main container adapted to receive a foam forming liquid; an auxiliary container filled with compressed gas and supported in said main container; foam forming means providing a cage for supporting said auxiliary container and comprising a proportioner for mixing said liquid and gas to form a foam and providing a seat for said auxiliary container, a gas supply conduit carried by said main container and connected to the inlet end of said proportioner to support said inlet end, a foam discharge conduit carried by said main container and connected to the outlet end of said proportioner to support said outlet end; a liquid supply conduit connected to said proportioner adjacent said outlet end to supply liquid to said proportioner so as to commingle said liquid and gas to form a foam; manually operable means for puncturing said auxiliary container to release said gas whereby said liquid and said gas are forced through said proportioner by the pressure of said gas to form foam; and means for directing said foam to a desired point of application.

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